Executive Summary

In June of 1999, a team was formed to develop an Integrated Natural Fuels Management Strategy for 2.09 million acres of federally managed lands in the southern Willamette Province. Administrative units include the **Willamette National Forest**, the **Eugene BLM** and portions of the **Salem BLM**.

The purpose of the Integrated Natural Fuels Management Strategy (**INFMS**) is to implement the 1995 joint federal fire management policy. The strategy addresses the increasing fiscal and human cost of aggressive fire suppression. It is an attempt to mitigate changes in ecosystem structure and function brought about by fire suppression.

The strategy proposes to use NEPA (National Environmental Policy Act) analysis to plan fuels activities that will bring landscapes into equilibrium with their fire environment. Proposals that use fire and other treatments to manipulate vegetation are included.

The strategy uses **Issues** identified by the public and by land managers to accommodate the presence of fire on public land. The team looked at issues in the context of **past, present** and **desired future condition** to develop goals for treatment to bring areas back into a more natural association with fire.

Recommendations of the strategy include:

- Use fire where it will reduce available fuels. Use mechanical treatment where fire is unacceptable. Suppress human-caused wild fires, fires near human habitation and other critical areas.
- Fire can be used to restore species such as white oak and to restore certain types of meadows. Fire may be used to create structure, such as snag patches, openings and other components of wildlife and fish habitat.
- Fire and mechanical treatment can be managed to time emissions for maximum air quality and to reduce landscape size fires and attendant smoke events.
- Fire managers must collaborate with the public on prescribed fire proposals. Where possible we will partner with adjacent land owners/managers to address fuels issues.
- Hazard and risk at the wild land urban interface must be addressed. Map structures, fuel conditions and travel routes in urbanized areas adjacent to public land. Use this information to develop contingency plans for Wild Land – Urban Interface communities. Assure that prescribed fires include adequate backup for all contingencies.

As summarized above, treatment is prioritized in this document. Landscapes that burned frequently prior to European settlement take

precedence. Factors such as slope, aspect, proximity to human habitation, and the presence of noxious weeds are also considered.

A particular site could be treated by using fire to meet resource objectives, or by a variety of mechanical treatments. Treatment method should be determined on a site-specific basis. Treatment method is a matter of some controversy and therefore is better addressed in a NEPA process. The NEPA process will allow the public formal opportunities to comment and to access the courts, if treatment proposals do not meet their needs.

The proposed program is expected to be costly, difficult and controversial in the short term. In the long term, however, the program should provide safer working conditions for firefighters, better protection of homes and businesses, lower suppression costs, less smoke intrusion, improved wildlife habitat, reduced spread of noxious weeds, and restoration of ecosystem structure and function.

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STRATEGY BY ISSUE

This document recommends strategies for fire and fuels management by individual issue. For each issue, a strategy was developed which enables managers to manipulate fuels and fire to reach a desired future condition (see **Appendix N**). For each issue, one or more of four types of treatment are recommended (see Methods of Fuel Reduction, page 11). The treatment types are:

- Wildland Fire for Resource Benefit (WFRB)
- Mechanical treatment
- Prescribed Burning
- Full Suppression

For the convenience of the reader, these strategies are summarized below.

SUMMARY OF STRATEGY BY ISSUE

Issue 1: Landscape Pattern and Habitat Diversity

Structure and function is much altered in drier areas.

- Prescribed fire and WFRB to restore structures such as oak, pine, and meadows.
- Mechanically treat some areas where fuel loads preclude Rx fire.
- Maintenance burning.

Some landscape elements missing from mesic forests.

- WFRB, Rx fire may create snag patches, openings, and other structures.

Issue 2: Wildlife Habitat Quality and Quantity

Fire is the function that maintains many wildlife habitat structures.

- Use WFRB and Rx fire to maintain influence of low intensity fire on habitat elements.
- Mechanically pre treat areas of altered habitat (especially valley/foothills).

Fire or mechanical treatment may cause direct mortality and loss of habitat for critical species.

- Manage timing and intensity of Rx fire and WFRB.

- Minimize habitat disturbance associated with mechanical treatment.

Issue 3: Insects and Disease

Loading of available fuel is very high in some insect outbreak areas.

- In the short term, mechanically treat near high-risk areas (campgrounds, etc)
- Alter stand structure to prevent/reduce outbreaks.
- Suppress fires near recent mortality areas.

Issue 4: Natural Fuels

High intensity fires are more frequent and present more risk to life and property than in the past.

- Use WFRB and Rx fire where it will reduce available fuels.
- Use mechanical treatment where fire is unacceptable.
- Suppress human caused fires, fires near WUI, and other critical areas.

Issue 5: Noxious Plants

Noxious weeds and invasive plants are effective at colonizing disturbed areas.

- Plant natives or sterile cereals on areas disturbed by fire or mechanical treatment.
- Where appropriate use hose lays, brush lines in place of mineral soil firelines.

Noxious weeds and invasive plants are spread by the movement of equipment and people.

- Treat weeds along roads near project sites.
- Wash equipment.
- Plant natives or sterile cereals on areas disturbed by fire or mechanical treatment.
- Prescribed fire may cause colonization of pristine meadows by noxious weeds and invasive plants.
- Burn weed infested meadows first, learn how to restore native communities.

Issue 6: Water Quality and Fish Habitat

Management actions have the potential to affect water quality.

- Use WFRB and prescribed fire to reduce incidence of high intensity, large scale fires.
- Use WFRB and prescribed fire to increase delivery of CWD.
- Use full suppression in critical areas (listed stocks, Municipal water).

Issue 7: Air Quality

Management actions have the potential to affect air quality.

- Use mechanical piling and burning to time emissions.
- Use Prescribed fire, WFRB to reduce landscape size fires and attendant smoke events.

Issue 8: Social Thresholds

People perceive wildland fire as all risk, no gain.

- Inform and collaborate with the public on WFRB and prescribed fire proposals.
- Assure that prescribed fire projects reduce future risks.
- Mechanical treatment is not an excuse for timber sales.

Checkerboard ownership is a challenge to fire management.

- Map ownership and land uses adjacent to public land.
- Partner with adjacent land owners/managers to address fuels issues.

Fire management in the Wildland Urban Interface is complex.

- Map structures, fuel conditions, travel routes in urbanized areas adjacent to public land.
- Use NEPA and other processes for shared learning.
- Listen to people.

Issue 9: Safety

Risk to firefighters can be reduced.

- WFRB to manage fires in remote areas safely.
- Alter fuels by prescribed fire.

- Mechanically treat to reduce loading in strategic locations.
- Full fire suppression will be used where necessary.

Risk to life and property can be reduced.

- Risk is concentrated in the Wildland Urban Interface (WUI).
- Mechanically alter fuel profiles adjacent to WUI – low thinning, etc.
- Contingency plans for at-risk communities.
- Prescribed fires include adequate backup for all contingencies.
- Develop a workforce capable of managing prescribed fire.

METHODS OF FUEL REDUCTION

Four primary methods for accomplishing natural fuel reduction have been identified.

1. **Wildland Fire for Resource Benefit** (WFRB) is an alternative to "full suppression" for natural ignitions occurring on areas where it is allowed under the unit's Fire Management Plan. It includes fire use strategies ranging from "limited suppression" to "no suppression," defines acceptable weather parameters, expected outcomes, and is subject to a daily review process.
2. Normal initial attack of a fire or selecting a suppression alternative through a Wildland Fire Situation Analysis (WFSA) is considered **full suppression**, even if the alternative selected is to "confine," "contain" or "control".
3. **Prescribed burning** defines management-ignited fire conducted under defined environmental parameters and with expected outcomes.
4. **Mechanical** treatment includes piling, chipping, thinning, or other treatment designed to change the loading or arrangement of fuels.

A. Wildland Fire for Resource Benefit

A Wildland Fire for Resource Benefit (WFRB) is an alternative to "full suppression" for natural ignitions occurring on areas where it is allowed under the unit's Fire Management Plan. It includes fire use strategies ranging from "limited suppression" to "no suppression," defines acceptable weather parameters, expected outcomes and is subject to a daily review process. An evaluation of the fire season and the risk associated with the WFRB is accomplished using the Rare Event Risk Assessment Process. The probability of a natural ignition decreases rapidly after September 1st (see Figure 1), as the probability of the fire season ending increases.

The amount of fuel reduced using this method is dependent on the timing of natural ignitions, the amount of risk that line officers are willing to accept, and many political and environmental factors. Fuel consumption is high in the smaller size classes; larger size classes are consumed more completely as the fire season progresses. Fire will affect the number and condition of snags and amount of large wood available. These effects are dependent on the fuel and weather conditions at the time of the fire event.

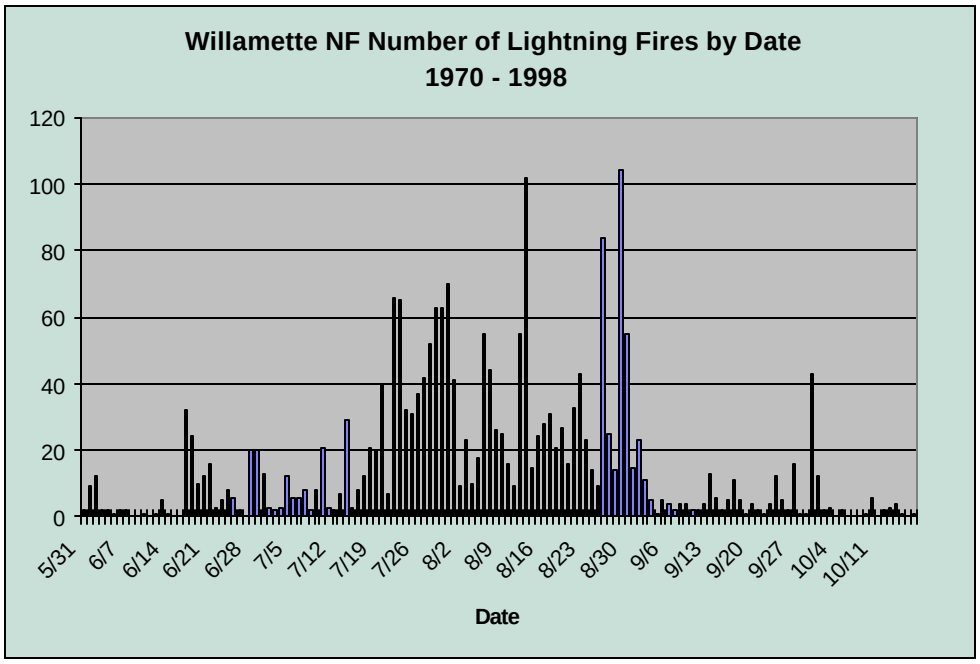

Figure 1. Willamette NF Number of Lighting Fires

B. Full Fire Suppression

Full fire suppression includes normal initial attack of a fire or selecting a suppression alternative through a Wildland Fire Situation Analysis (WFSA) including "confine," "contain" or "control" strategies. Consumption is more complete in all size classes and conditions of fuel.

C. Prescribed Burning

Prescribed burning is a planned use of fire to meet defined resource objectives and requires extensive preparation. This includes defining environmental and social parameters under which the project will be conducted, and the expected results. Preparation includes credible burn plans; assigning qualified personnel; sufficient resources available to contain escapes; current weather forecasts; and strong coordination with adjacent units. Fires can be prescribed to accomplish fuel reduction in the larger fuel size classes and will normally consume the smaller size classes more completely.

D. Mechanical Treatments

Mechanical treatments reduce or rearrange fuels in an area. Mechanical treatments may include piling of slash, lopping and scattering, pre-commercial and commercial thinning, yarding of tops in thinning sales, chipping, and requirements to yard small material in timber sales. Treatments involving piling may include burning of those piles.

This type of fuel reduction is effective on ladder fuels and can assure the preservation of certain size classes or conditions of fuels better than using fire as a treatment method. The amount of fuel left in smaller size classes (the major contributor to rate of spread of a fire) is larger than after a fire treatment. Opportunities to accomplish fuel reduction are not based on weather factors. Therefore this treatment method can be accomplished over a longer period of time during the year than treatments using fire.

INTRODUCTION TO THE STRATEGY

In this document, fuels treatment is prioritized by **issue** and by **treatment type**. For most issues, 'key points' of a particular issue are identified, often by fire regime. For each of these key points, strategic recommendations are made for when and where each of four treatment types is appropriate. It is hoped that by using this format, strategic recommendations will provide decision support to the user, without specifying exactly where and when a particular treatment should take place. This is important for two reasons: first because the NEPA process is the place to do site specific analysis and second because our analysis was strategic and not tactical, and does not contain enough detail to be site specific.

ISSUE 1: LANDSCAPE PATTERN AND VEGETATIVE DIVERSITY

Fire has influenced the structure, composition and pattern of landscapes for centuries. Fire regimes (frequency, severity and size of historic fires) are key building blocks for understanding the role of fire in the landscape, and assessing the effects of fire suppression and other activities on current conditions. A discussion of the creation of fire regimes is found in **Appendix C:** Fire Zones and Fire Regimes.

Within the INFMS area, five fire regimes influenced the landscape. Fire regimes affected vegetation structure, composition and pattern differently. In Regimes 1 and 2 (lower severity/higher frequency regimes) fires kept fuel loadings low, and favored grassy and grass/shrub understories and fire-adapted tree species (*e.g.*, ponderosa pine, sugar pine and oak). In variable severity regimes 3 and 4, fire events created large snags and down wood, temporary openings, and created opportunities for post-fire tree regeneration**.** In the high severity/low frequency Fire Regime 5, fires infrequently created large temporary open patches, a large influx of snags and down wood, and created new stands with an increase in species diversity

Current conditions have been altered by fire suppression, management practices and human development. Stand and landscape composition and structure have changed or been lost. This, in turn, has influenced habitat effectiveness and wildlife community. Some of the following key points address both vegetation conditions as well as wildlife habitat conditions. For a full discussion of the Landscape pattern and vegetation diversity issue, see **Appendix D**. More detailed information on fire regimes and fire zones can be found in **Appendix C**. For additional key points that affect wildlife, see Issue 2: Wildlife Habitat Quality and Quantity.

Strategy recommendations for this issue are listed below. It is important to note that **achieving some of the strategy objectives, in the short**

term, may be in conflict with current policies, such as survey and management direction (see **Appendix A** for discussion).

Key Points

1.1. Low severity/high frequency and variable severity/high frequency regimes (Regimes 1 and 2).

Condition: Current species composition (plant and animal), structure and pattern conditions in *low severity/high frequency and variable severity/high frequency regimes (Regimes 1 and 2)* have been lost or extremely altered due to agriculture, human development and fire suppression. Virtually all prairie, oak openings and meadows are gone. Some stands have high fuel loading, multiple, layers, and/or a decrease in oak, ponderosa pine and sugar pine components.

Goal: Create, restore and maintain structure and function in prairie, oak and dry Douglas fir sites (*e.g.*, protecting existing large Douglas fir, ponderosa pine and sugar pines; recruitment of ponderosa pine, sugar pine and oak; creating and maintaining native understory grass and shrub components).

Recommendations

1.1.A. Wildland Fire for Resource Benefit

Objectives: Opportunities exist to reduce current fuel loading (surface and vertical fuel ladders) if fires are of low to moderate severity and fire effects will maintain existing large ponderosa pine, sugar pine, oak and Douglas-fir components (including large snags). This tool may be useful in ponderosa pine plantations as well as in low severity fire situations. Wildland fire in prairies, meadows and oak openings that increase native grass and herb vigor and reduce unwanted conifer or non-native herb/shrub encroachment should be encouraged.

Considerations: Consider using this treatment in areas where unwanted or noxious weeds are not an issue. Consider seeding desired understory species after a burn to reduce non-native competition. Consider spatial and temporal effects of burning on habitat and population control of exotic plant and animal species. Also, consider spatial and temporal effects of burn on wildlife linkages and corridors (including potential avenues for exotic species invasion).

1.1.B. Full Suppression

Considerations: Consider only if goals and objectives cannot be met or other resources would be negatively impacted (*i.e.*, high

severity fire in mid to late seral stands, noxious weeds/non native species concerns).

1.1.C. Prescribed Burning

Objectives: This method could be used to reduce existing fuel loading, or as a maintenance tool to keep open stand conditions, stimulate vigor of understory species, keep fuel loading low, etc. It is a high priority method as it allows for control in the placement, timing and degree of severity on the landscape

Considerations: Consider the following:

- Plant and animal phenology (*e.g.*, plant seed set, nesting and roosting) to determine best time to burn to achieve desired effects.
- Fire proofing large ponderosa pine and oak species (*e.g.*, raking around base) to discourage injury/mortality.
- Using prescribed burning as a tool to kill encroaching trees in prairies and in areas where noxious weeds aren't an issue.
- Seeding desired species after a burn to reduce non-native/unwanted species competition.
- Spatial and temporal effects of burning on habitat and control of exotic animal species.

1.1.D. Mechanical Treatment

Objectives: Some stands may require initial mechanical treatment (*i.e.*, removal of lower small diameter canopy layers) to reduce vertical fuel profiles and protect existing large Douglas fir, ponderosa pine, sugar pine and oak. Thin from below and create spatial diversity with gaps. Ponderosa pine and sugar pine may be need to be planted into gaps.

Early seral stands could be thinned to encourage open stands with ability to grow big trees. Existing ponderosa pine or oak should be favored and encouraged to grow.

Considerations: Consider using as initial treatment in oak stands where non-natives have taken over. Consider this tool in highly disturbed sites in the wildland urban interface. Multiple treatments may be necessary before maintenance burning occurs.

1.2. Variable severity/moderate frequency and variable severity/low frequency (fire regimes 3 and 4)

Conditions: Some structures and landscape pattern components of *variable severity/moderate frequency and variable severity/low frequency (fire regimes 3 and 4)* have been altered.

Goals: Restore and/or maintain fire effects in this regime such as: temporary openings, regeneration opportunities (creation of tree cohorts), large size class snags and down wood components, large trees, and structural heterogeneity.

Recommendations

1.2.A. Wildfire for Resource Benefit

Objectives: Opportunities exist to reduce current fuel loading (surface and vertical fuel ladders) in some stands. Wildland fire of low to moderate severity can increase heterogeneity by increasing native understory health and vigor, creating some snags, openings, and creating seedbed characteristics for regeneration. This method is an important tool to maintain desired conditions.

Considerations: This is **not** a tool for early seral stands. Consider using this treatment in areas where noxious weeds or unwanted non-native species are not an issue. Consider effects of burning on native and exotic plant and animal species. Also, consider spatial and temporal effects of burn on wildlife linkages and corridors (including potential avenues for exotic species invasion).

1.2.B. Full suppression

Considerations: Consider using this tool *only* if goals and objectives cannot be met or other resources would be negatively impacted (*i.e.*, high severity fire in mid to late seral stands, noxious weeds/non native plant and animal species concerns).

1.2.C. Prescribed burning

Objectives: This could be a very effective tool to reduce fuel loading or maintain desired conditions (*i.e.*, openings, large snags and down wood). It is a high priority method because it allows for control in the placement, timing and degree of severity on the landscape.

Considerations: Consider plant and animal phenology (*e.g.*, plant seed set, resistance to burn, wildlife nesting and roosting) to determine best time to burn to achieve desired effects.

1.2.D. Mechanical Treatment

Objectives: Some stands may require initial mechanical treatment (*i.e.*, removal of lower small diameter canopy layers) to reduce vertical fuel profile (layering) and protect large Douglas fir. Thin from below to create spatial diversity with gaps.

Considerations: Consider creating and/or maintaining wildlife habitat elements (*e.g.*, snags, down wood). Multiple treatments may be necessary before maintenance burning occurs.

1.3. Low frequency/high severity regime (Fire regime 5)

Condition: Some elements of landscape pattern, structure and composition characteristics have been altered in the *low frequency/high severity regime (Fire regime 5).*

Goal: Temporary openings, big pulses of large snags and downed wood and species diversity are key effects of fire to be introduced.

Recommendations

1.3.A. Wildfire for Resource Benefit

Objectives: Opportunities exist to create landscape heterogeneity by creating snag patches, and variable post-fire stand conditions (from creeping ground fires). Consider using this as a tool to increase heterogeneity by creating some snags, openings, especially in areas where other resource concerns are low (*e.g.*, wilderness areas)

Considerations: This is *not* a tool for early seral stands. Consider using this tool when other resources will not be negatively impacted, and noxious weeds are not an issue. Consider spatial and temporal effects of burn on wildlife linkages and corridors (including potential avenues for exotic species invasion).

1.3.B. Full suppression

Considerations: Consider this treatment *only* if goals and objectives cannot be met or other resources would be negatively impacted.

1.3.C. Prescribed burning

Objectives: This technique could be used in areas where there is a need to control the placement, timing and degree of severity on the landscape.

Considerations: Consider plant and animal phenology (*e.g.* plant seed set, resistance to burn, wildlife nesting and roosting) to determine best time to burn to achieve desired effects.

1.3.D. Mechanical Treatment

Objectives: Consider using this tool in areas where fire risk is moderate or high (*e.g.*, in areas of heavy insect outbreaks or pathogen activity), or other resource issues would be impacted if fire were used.

1.4. Dry meadows and non forested habitats

Condition: Some *dry meadows and other non-forested habitats* at least partially maintained by fire historically have been impacted by suppression and management practices. Tree encroachment and degradation of sites by non-native species are occurring.

Goal: Restore and maintain these sites.

Recommendations

1.4.A. Wildland Fire for Resource Benefit

Objectives: Opportunities exist to kill encroaching trees in meadows and increase vigor in existing native meadow species.

Considerations: Consider using this treatment in areas where noxious weeds are not an issue, or can be controlled. Consider seeding desired understory species after a burn to reduce non-native competition if necessary.

1.4.B. Full Suppression

Considerations: Consider *only* if goals and objectives cannot be met or other resources would be negatively impacted

1.4.C. Prescribed Burning

Objectives: This tool could be used kill encroaching trees in meadows and increase vigor in existing native meadow species. It is an excellent **maintenance** tool, offering maximum flexibility in type, timing and severity of burn.

Considerations: Consider plant and animal phenology (*e.g.*, plant seed set, resistance to burn, wildlife nesting and roosting) to determine best time to burn to achieve desired effects. Consider using as tool to kill encroaching trees in areas where noxious weeds aren't an issue, or can be controlled. Consider seeding desired species after a burn to reduce non-native/unwanted species competition.

1.4.D. Mechanical Treatment

Objectives: This method can be considered in places where burning would negatively impact resources (*e.g.*, existing large population of noxious weeds on or adjacent to site, high fire risk).

Considerations: Consider using as initial treatment in areas where non-natives have taken over or in areas of other resource concerns. Multiple treatments may be necessary before maintenance burning occurs.

ISSUE 2: WILDLIFE HABITAT QUALITY AND QUANTITY

The variation and combination of habitat patterns as a result of fire are infinitely complex. It is because of this complexity that it is difficult to identify predictable responses of wildlife to fire and its affects. It is necessary to address wildlife habitat quality and quantity considerations in the natural fuels strategy because fire and fuel reduction methods can be both beneficial and detrimental to wildlife habitat and species. Therefore, planning for fuel reduction opportunities on the landscape needs to have clear objectives that consider the needs of wildlife. A detailed discussion of the issue of habitat quality and quantity can be found in **Appendix E**.

General INFMS strategy recommendations for fauna

Clear objectives need to be developed using fire or other tools in a landscape that has been impacted by fire suppression and other alterations for decades. Managers must decide how or when fire and/or fuels treatment will be used to address site-specific or landscape level fauna/habitat relationships. Site specific and landscape level objectives and considerations should include:

1. Maintaining nesting and denning habitat for federally endangered and Forest or BLM listed sensitive species (as a minimum).
2. Ensuring preservation of enough habitat features needed for the reproduction of fauna at each key level of the ecosystem.
3. Recognizing that wildlife species will be most vulnerable to direct detrimental effects from fire during nesting and rearing seasons when mobility is limited.
4. Considering wildlife travel corridors between large blocks of intact forest not fragmented by clearcuts.
5. Avoiding the creation of roads or invasion corridors (avenues for exotic invasion) during implementation.
6. Including minimum large fuel moisture levels in burn plans to minimize the effects of fires on small mammals.

Key Points

2.1. Habitat Elements

Fire has been a key process creating habitat elements (*e.g.*, snags, logs, fungi) essential to wildlife in our past and present landscape. Current suppression efforts have curtailed many of the low to moderate severity fires that played an important role in maintaining/creating habitat elements.

Goal: Create habitat elements in similar numbers, densities, timeframes, and locations that fire created in the past. Following the goals and objectives outlined in the Landscape pattern and vegetative diversity section will help achieve this goal.

Recommendations

2.1.A. Wildland Fire for Resource Benefit

Objectives: This method has the potential to most closely mimic the fires that created wildlife habitats found in the analysis area today. This tool may be most effective where human modifications and exotic establishment is minimized. Objectives for this tool will vary depending on fire regime:

- **Regime 1 and 2** – Use this tool when the predicted fire intensity will be low or moderate. Use where small pockets of higher severity fire are acceptable (creating snag pockets), and where it is likely that a more open forest condition will result.
- **Regimes 3 and 4** – Use this tool when the predicted fire severity will remain low. Use where low severity understory burning and only small overstory modifications (an occasional snag or snag pocket) is the likely outcome.
- **Regime 5** – This tool can be used in this regime to create large patches of snags, open even-aged forest stands, and add between stand variability to large homogenous patches of mountain hemlock/silver fir. Variable intensity and severity are acceptable.

Considerations:

- Implementation must include spatial and temporal consideration for habitat patterns, linkages, and corridors that will meet the needs of the endemic wildlife species at the stand and landscape scales.
- Treatment Timing Considerations - Consider allowing larger burns when desired habitat effect is most likely. For example, allowing a larger burn in late summer may create a larger area of stand replacement effects rather than low intensity effects (large snag patches vs. within stand heterogeneity). Carefully consider the goal for Zone, Regime, Stand and choose the correct tool.

2.1.B. Full Suppression

Objectives: This approach is appropriate in many circumstances found in all fire regimes to maintain unique habitats or protect individuals or populations of various wildlife species.

Considerations:

- Consider in areas where fuel loading indicates that high severity fire is likely to occur.
- Consider in areas where prescribed fire or mechanical treatment are better tools than wildfire to reach habitat objectives (they can be implemented at a later date).
- Consider when conditions indicate that fire behavior will be too erratic or severe to result in desired habitat modifications.

2.1.C. Prescribed Burning

Objectives: This method can also mimic fires that have created existing wildlife habitats. Objectives for this tool will vary depending on fire regime

- Regime 1 – Create vegetation conditions described in the Landscape pattern and vegetative diversity section. Use when predicted results will favor native grassland wildlife species
- Regime 2 – Use this tool when the predicted fire severity will be low or moderate. Use to create snag pockets, more open understories, and meadow openings. Use to reduce the competitive advantage of Douglas fir and enhance survival of pines and oaks where suitable. Use to maintain open grass/forb or shrub understory conditions in dry Douglas fir sites.
- Regimes 3 and 4 – Use this tool when the predicted fire severity will remain low. Use to create small within stand modifications such as occasional snags or snag pockets, understory variations, canopy layers.
- Regime 5 – This tool can be used in this regime to create snag patches and between stand variability in large homogenous forests of mountain hemlock/Pacific silver fir. Variable severity is acceptable.

Considerations:

- Consider in areas where fuel loading allows for understory modification with low severity burns.
- Consider creating projects at a large enough scale to allow prescribed fire to create several "jackpots" of the desired habitat elements or modifications.
- Consider surrounding landscape and the condition and types of adjacent habitats. The prescribed burn will make the landscape

pattern more homogenous or more heterogeneous. Determine which pattern outcome is most desirable in the project area.

- Consider burning when desired habitat effect is most likely. Early spring burns yield different vegetative responses from fall burns. Carefully consider the goal for Zone, Regime, Stand and choose the correct tool.

  NOTE: This consideration may contradict avoiding the time period when wildlife is most vulnerable to direct fire effects. Carefully weigh benefits and drawbacks. Generally, benefits will be positive habitat changes for some species and detriments will be direct mortality or loss of the yearly reproductive effort of some individuals. Careful project design can eliminate or mitigate most conflicts.

- Consider multiple entries to achieve desired habitat effect (*i.e.*, may have 3-5 entries in a decade, perhaps the first 1 or 2 are mechanical). This may help avoid harsher one-time-entry direct effects.

2.1.D. Mechanical Treatment

Objectives: Mechanical methods could provide benefits for various suites of wildlife species but the objectives may vary depending on the Fire Regime.

- Regime 1 – greatest wildlife benefits are in Valley bottomlands that were historically grass/forb communities, hardwood stands or pine savannahs and are now shrub (often exotic) communities or dense conifer woodlands. Mechanical treatments may be necessary for first (perhaps several) entry to reduce shrubby/midlevel understory.

- Regime 2 – greatest wildlife benefit would be realized in Valley & Foothills and the South Cascade Zones particularly along the wildland/urban interface. Create open Douglas fir forests (conifer understory removal), enhance survival of oaks and pines (conifer density reduction from oak/pine sites), maintain meadow openings (young conifer removal from meadow perimeters), and exotic shrub reduction/eradication are all habitat element objectives that can be addressed using mechanical methods.

- Regime 3 and 4 – greatest wildlife benefit would be realized in Low Cascade and Coast Range Zones. Create within-stand heterogeneity (*i.e.*, snags, down wood, and small openings - selective understory removal, snag creation), create conditions for large diameter tree growth (PCT and commercial thinnings), and multi-layered canopies. Also, encourage greater vegetation species diversity.

Considerations:

- Consider in areas where fuel loading is too high to maintain low severity burns.
- Consider as a first entry opportunity to prepare an area for future mechanical and prescribed fire entries. Also it is an opportunity to achieve more controlled habitat modification.
- Avoid some mechanical methods that can be detrimental to wildlife habitat. For example, if downed wood is piled and burned, cover for small mammals, amphibians and reptiles and certain birds could be severely reduced.
- Consider surrounding landscape and how habitat modification in the specific site will fit with the existing habitat in the area.

2.2. Direct mortality or Habitat loss

Fire has been and is a basic ecological process that creates habitat and/or food sources, but a fire event can also result in direct mortality or loss of habitat.

Goal: Minimize direct mortality and loss of habitat for desired species while maximizing habitat element creation and long-term habitat modification.

Recommendations

2.2.A. Wildland Fire for Resource Benefit

Objectives: Avoid using this tool when timing, location, or intensity of the fire will likely result in high direct mortality for resident wildlife.

Considerations:

- Consider surrounding landscape and availability of adjacent habitat to support similar wildlife species composition.
- Evaluate escape habitat or corridors when developing modified perimeters.
- Consider time of year and avoid including known breeding or nesting sites during nesting and rearing time period when developing modified perimeters.

2.2.B. Full Suppression:

Objectives: This approach is appropriate in many circumstances found in all fire regimes to maintain unique habitats or protect individuals or populations of various wildlife species.

Considerations:

- Consider in areas where fuel loading indicates that high severity/high intensity fire is likely to occur.
- Consider in areas where prescribed fire or mechanical treatment are better tools than wildfire to reach habitat objectives (they can be implemented at a later date).
- Consider in areas where threatened, endangered or special status species nests or key habitat elements cannot be avoided or protected.
- Consider when conditions indicate that fire behavior will be too erratic or severe to result in desired habitat modifications.
- Consider when wildlife species are vulnerable to direct detrimental effects from fire during nesting and rearing seasons when mobility is limited.

2.2.C. Prescribed Fire

Objective: Similar for WFRB, however there may be opportunity to use this tool in stages or in combination with other tools to modify smaller patches of habitat within a designated unit over several entries. This could allow wildlife to avoid the fire, repopulate, or relocate within nearby similar habitat.

Considerations:

- Evaluate desired wildlife species composition prior to treatment. Fire will affect the competitive advantage, favoring some species and not others. Consider combining fire with other methods to achieve desired species composition (*i.e.*, discourage exotic species such as starlings, bullfrogs, rock doves).
- Consider creating projects at a large enough scale to allow prescribed fire to create several "jackpots" of the desired habitat elements or modifications.
- Consider surrounding landscape and the condition and types of adjacent habitats. The prescribed burn will make the landscape pattern more homogenous or more heterogeneous. Determine which pattern outcome is most desirable in the project area.
- Consider how to maintain linkages and corridors. Also, examine opportunities for creating future linkages and corridors when planning burning patterns.
- Consider burning when desired habitat effect is most likely. Early spring burns yield different vegetative responses from fall

burns. Carefully consider the goal for Zone, Regime, Stand and choose the correct tool.

NOTE: This consideration may contradict avoiding the time period when wildlife is most vulnerable to direct fire effects. Carefully weigh benefits and drawbacks. Generally, benefits will be positive habitat changes for some species and detriments will be direct mortality or loss of the yearly reproductive effort of some individuals. Careful project design can eliminate or mitigate most conflicts.

- Consider multiple entries to achieve desired habitat effect (*i.e.*, may have 3-5 entries in a decade, perhaps the first 1 or 2 are mechanical). This may help avoid harsher one-time-entry direct effects.

2.2.D. Mechanical Treatment

Objectives: Minimize disturbance and potential mortality to wildlife during treatment.

Considerations:

- Consider in areas where burning would result in higher wildlife mortality.
- Consider as a first entry opportunity to prepare an area for future mechanical and prescribed fire entries. Also it is an opportunity to achieve more controlled habitat modification while minimizing direct effects.
- Avoid some mechanical methods that can be detrimental to wildlife habitat. For example, if downed wood is piled and burned, cover for small mammals, amphibians and reptiles and certain birds could be severely reduced.
- Consider surrounding landscape and how habitat modification in the specific site will fit with the existing habitat in the area.
- Consider opportunities for maintaining linkages and corridors when developing modified perimeters. Also examine opportunities for creating future linkages and corridors when establishing perimeters.
- Consider plant and animal phenology to determine best time for desired effect (*i.e.*, timing the project to minimize compaction may improve survival of desirable plants and reduce creation of disturbed soil for exotics to exploit).

2.3. Species Composition

Fire effects on present habitat composition will not simulate historic conditions because of changes in plant species composition (weeds and exotics) and animal species composition (competition with exotics).

Goal: *Approximate* habitat conditions suitable for endemic species.

NOTE: This Key Point is addressed in Issue 1: Landscape Pattern and Vegetative Diversity.

2.4. Threatened, Endangered or Special Status Species

Species that are considered threatened or endangered today may have occurred in low numbers/densities or discreet patches in the past but were maintained in a landscape where fire was an integral process. In addition, species that have received a special status designation from the agencies (sensitive, survey and manage etc.) had some former relationship with fire that is not entirely understood today.

Goal: Implement habitat modifications without contributing to any reduction in threatened, endangered, or special status species population viability.

Recommendations

2.4.A. Wildfire For Resource Benefit:

Objective: Avoid including known nesting sites or buffered sites for any threatened, endangered species within the modified perimeter. Target species will differ by regime:

- Regime 1 – Create habitat for grassland species such as Fender's Blue Butterfly, but avoid incorporating occupied habitat into the burn perimeter while the butterfly is present or its host plant is vulnerable.
- Regime 2 – Do not include known nest sites for northern spotted owls within the modified perimeter.
- Regimes 3 and 4 – Do not include known nest sites for northern spotted owls, marbled murrelets, or bald eagles (category 3) within the modified perimeter. Exploit opportunities to create stand structure desirable to these species in suitable but unoccupied habitat.
- Regime 5 – Be aware that nomadic large predators such as lynx exploit these environments. Take opportunities to enhance habitat for these species when possible.

Considerations:

- Consider opportunities to maintain linkages and corridors for threatened, endangered and special status species when developing modified perimeters. Also, examine opportunities for creating future linkages and corridors for these species when establishing perimeters.

2.4.B. Full Suppression:

Objective: This approach is appropriate in many circumstances found in all fire regimes to maintain habitat or protect individuals or populations of threatened, endangered or special status species.

Considerations:

- Consider in areas where prescribed fire or mechanical treatment are better tools than wildfire to reach habitat objectives (they can be implemented at a later date).
- Consider in areas where threatened, endangered, or special status species nests or key habitat elements cannot be avoided or protected.
- Consider when conditions indicate that fire behavior will be too erratic or severe to result in desired habitat modifications.
- Consider when threatened, endangered, or special status species are vulnerable to direct detrimental effects from fire during nesting and rearing seasons when mobility is limited.

2.4.C. Prescribed Fire:

Objectives: Time prescribed burning to avoid occupied nesting sites of any threatened or endangered species within the area. Target species will differ by regime:

- Regime 1 – Use this tool to create habitat for grassland species such as Fender's Blue Butterfly but *carefully* consider fire effects before incorporating occupied habitat into the burn perimeter.
- Regime 2 – Do not include known nest sites for northern spotted owls within the burn boundary unless habitat improvement for this species is the goal of the project. Careful preparation, timing, and coordination with all concerned entities are essential.
- Regimes 3 and 4 – Do not include known nest sites for northern spotted owls, marbled murrelets or bald eagles (category 3) within the burn boundary unless habitat improvement is the goal of the project. Exploit opportunities to create stand structure desirable to these species in suitable but unoccupied habitat.

- Regime 5 – Be aware that nomadic large predators such as lynx exploit these environments. Take opportunities to enhance habitat for these species when possible.

Considerations:

- Consider opportunities for maintaining linkages and corridors for threatened, endangered or special status species when developing prescribed burn projects. Also, examine opportunities for **creating** future linkages and corridors for these species when establishing perimeters.
- Consider creating projects at a large enough scale to allow prescribed fire to create several "jackpots" of the desired habitat elements or modifications for threatened, endangered or special status species.

2.4.D. Mechanical Treatment

Objective: Improve and/or increase habitat for threatened, endangered and special status species. Avoid detrimental modifications to any individual or population. Target species will differ by regime:

- Regime 1 – Create and Enhance grassland habitats.
- Regime 2 – Create more open and diverse habitat conditions. However, do not modify habitat around known nest sites for northern spotted owls unless habitat improvement for this species is the goal of the project. Careful preparation, timing, and coordination with all concerned entities are essential.
- Regime 3 and 4 – Do not modify known nest sites for northern spotted owls, marbled murrelets or bald eagles (category 3). Exploit opportunities to create stand structure desirable to these species in suitable but unoccupied habitat.
- Regime 5 – Be aware that nomadic large predators such as lynx exploit these environments. Take opportunities to enhance habitat for these species when possible.

Considerations:

- Consider as a first entry opportunity to prepare an area for future mechanical and prescribed fire entries. Also, it is an opportunity to achieve more controlled habitat modification when near areas that hold value to threatened, endangered or special status species.
- Consider timing of projects. Avoid entry into areas that hold value for threatened, endangered, and special status species during occupied and/or vulnerable periods.

ISSUE 3: INSECTS AND PATHOGENS

Some insects and pathogens have existed and evolved with fire in the landscape for centuries. In high elevation forests, for example, the extent and severity of insect outbreaks were partially controlled by fire. Historic pathogen levels helped control fire spread and were (at least partially) controlled by fire frequency and severity. Fuel loadings were also influenced by insect and pathogen activity.

The High Cascades Zone has experienced epidemic insect outbreaks. A suspected cause of this is fire suppression, which has altered stand composition, structure and landscape pattern. (See **Appendix F** for full discussion of issue.)

Key Points

3.1. Existing insects/pathogens

Condition: Fuel loading in some **existing** insect outbreak areas are very high.

Goal: Reduce fuel hazard in these areas and adjacent landscapes to help decrease fire risk and outbreak spread.

3.2. Future insect/pathogens

Condition: Current vegetation structure and pattern (especially in high elevation forests) due to fire suppression may be favoring increased **future** insect and pathogen activity.

Goal: Alter compositional and structural conditions to more closely represent historical landscapes in strategic areas to help decrease the probability of future insect outbreaks and pathogen spread

Recommendations (for both Key Points)

3.2.A. Wildland Fire for Resource Benefit

Objectives: This may be an important tool to alter composition, structure and pattern using the appropriate process (fire) in areas where fuel hazard, noxious weeds and social risks are acceptable (*e.g.*, selected sites in wilderness areas).

3.2.B. Full Suppression

Considerations: Consider using this technique in areas where resources or property would be negatively impacted.

3.2.C. Prescribed Burning

Objectives: This is a good option as it gives managers the utmost flexibility in where and when fire can be used to achieve insect and pathogen goals. It can be used alone or in conjunction with mechanical treatments.

Considerations: Consider using this tool in areas where other resource issues will benefit, or won't be negatively impacted.

3.2.D. Mechanical Treatment

Objectives: This method can be used in areas of high current fire risk. Thinning small trees to minimize layering only in infected and adjacent stands may help reduce insect spread.

ISSUE 4: NATURAL FUELS

Historically, naturally occurring fires and fire use by Native Americans provided low overall fuel loading in many areas. Large fires were common, burning a higher percentage of area with low to moderate fire intensity than typically occurs today.

Over the past 100 years, perceived values and varied ownership patterns have resulted in the development of an effective fire suppression program. In many cases, this has contributed to developing additional improvements across the landscape and supported changes in lifestyle that include many uses of our wildlands.

Another result of fire suppression effectiveness has been the increase of fuel loads across much of the landscape. Forest fuels are accumulating at an increasing rate, making fire suppression efforts less effective and average escaped fire sizes larger (see Figure 2). During the period from the 1930s through the 1990s, the increase in escaped fire sizes demonstrates the effects of increased fuels accumulation.

Fires are more frequently of high intensity. Public and firefighter safety

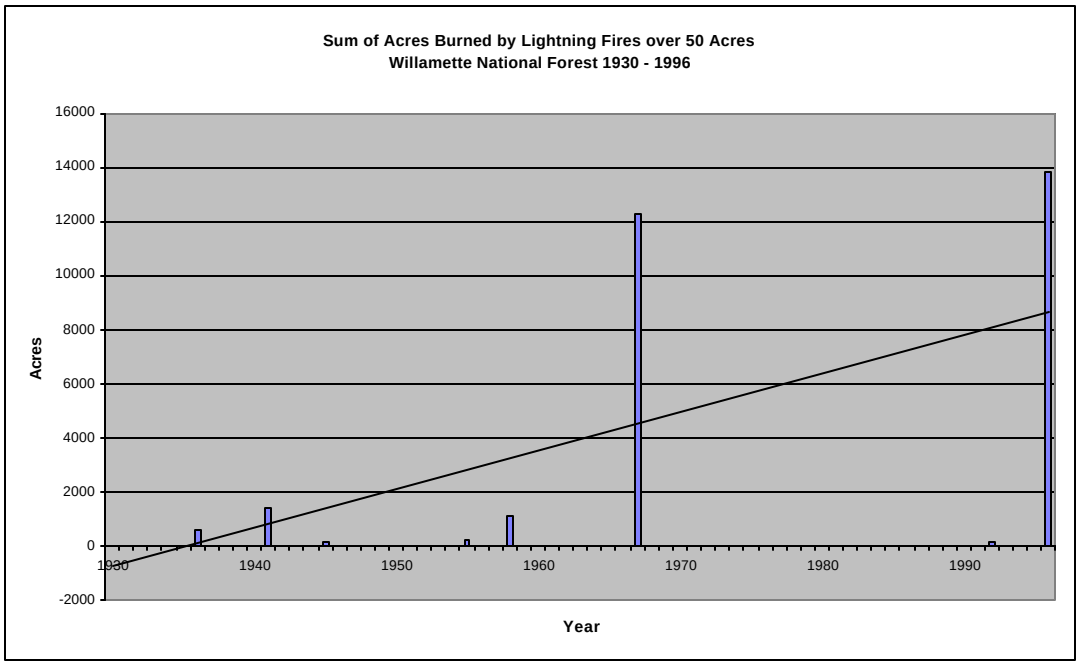

Figure 2. Sum of Acres Burned by Lightning Fires over 50 Acres.

is becoming difficult to provide, and actions to protect improvements (structures created by humans) and values threatened by wildfire are becoming more hazardous.

Effects of a successful program of fuel reduction will include a more fire resistant forest with a variety of opening sizes and seral stages across the landscape. The resulting stand conditions will provide increased public and firefighter safety, and better protection of improvements and other values at risk.

Detailed information on natural fuels can be found in **Appendix G**.

Key Point

Condition: High intensity fires are more frequent than in the past. Public and firefighter safety are becoming more difficult to provide, and actions to protect improvements are becoming more hazardous.

Goal: To accomplish significant amounts of fuel reduction, resulting in less intense fire, using an appropriate method while maintaining a proper level of protection to resources and values.

Recommendations

4.A. Wildland Fire for Resource Benefit (WFRB)

Fuel reduction can be accomplished using this method in areas defined by the unit's Fire Management Plan and is effective where there are factors creating hazardous conditions for firefighters. WFRB can also be considered when there is low risk to improvements, resource values and other ownerships when weather and fuel conditions are not too dry. The amount of area treated is dependent on the location of natural ignitions, current and predicted weather systems and the managers' interpretation of risk factors. This method will contribute a small quantity of fuel reduction in the program initially; possibly more after fuel treatments have provided areas with reduced fuel loads as perimeters.

4.B. Full Fire Suppression

In areas where risks to values and resources posed by a WFRB are unacceptable, the fire is human caused or in areas where WFRB is not an option as determined by the Fire Management Plan, suppression of fire will occur. The amount of area treated is dependent on the strategy used and the outcome of suppression on individual fires. It has potential to contribute to fuel reduction more than in the past due to fires becoming increasingly hazardous to suppress.

4.C. Prescribed Burning

Projects can be implemented in areas where, and at times when risks to resources and values are acceptable or can be mitigated and there is a good probability of meeting land management objectives. The amount of area treated is dependent on successful land management project planning. This method will contribute a significant quantity of fuel reduction in the program; especially in the shorter fire return intervals.

4.D. Mechanical Treatment

On sites where the resources will not be adversely impacted and that fire use poses an unacceptable level of risk to improvements, resource values or other ownerships mechanical methods should be considered. Also, consider mechanical means in areas where the stand composition or Condition Class is such that too much fuel exists on the ground or as ladders up into the canopy. Fuel reduction projects can be accomplished while allowed by the Industrial Fire Precaution Level and the effects on resources are acceptable. The amount of area treated is dependent on successful land management project planning. This method will contribute a significant quantity of fuel reduction in the program, especially in the longer fire return intervals and near improvements and other ownerships.

ISSUE 5: NOXIOUS AND INVASIVE PLANTS

Non-indigenous plants may threaten natural values and have negative economic consequences. Some species displace native plants and some species increase fire hazard. Some species increase because of fire or firefighting.

Key Points

5.1. Invasive plants are spread by disturbance.

Noxious and invasive plants are often aided in their spread by disturbance, such as fire and mechanical treatment.

Recommendations

5.1.A. Wildland Fire for Resource Benefit

On disturbed areas, consider competitive planting of native species or sterile cereal species.

5.1.B. Full Suppression

On disturbed areas, consider competitive planting of native species or sterile cereal species.

5.1.C. Prescribed Fire

- Consider brush lines and waterlines in place of mineral soil fire lines.
- On disturbed areas, consider competitive planting of native species or sterile cereal species.

5.1.D. Mechanical Treatment

On disturbed areas, consider competitive planting of native species or sterile cereal species.

5.2. Noxious and invasive plants are spread by movement of vehicles, equipment, people and livestock.

Noxious and invasive plants are often aided in their spread by movement of vehicles, equipment, people and livestock.

Recommendations

5.2.A. Wildland Fire for Resource Benefit

Consider competitive planting of native species, or sterile cereal species.

5.2.B. Full Suppression

- Minimize use of vehicles, especially off established roads.
- Wash wheeled and tracked equipment before and after working a particular incident.

5.2.C. Prescribed Fire

- Design projects to minimize use of vehicles, especially off established roads.
- Treat weeds in project areas before prescribed burning to prevent spread.
- Treat weeds on travel routes to the site before commencing operations.
- Wash wheeled and tracked equipment before and after working a project.

5.2.D. Mechanical Treatment

Minimize transport of noxious plant seeds by:

- Treating weeds along roads leading to the project site.
- Washing wheeled and tracked equipment.

5.3. Prescribed fire may cause weeds to invade pristine meadows

Undisturbed meadows (and other pristine habitats) are particularly vulnerable to weed infestation caused by prescribed fire activities.

5.3.A. Prescribed Fire

Rather than burning undisturbed meadows, place burning projects in weed-infested, already degraded areas. Design projects to test the effects on weeds of burning and competitive planting of local, native species.

ISSUE 6: WATER QUALITY AND FISH HABITAT

Current and past fire suppression activity has created some riparian vegetative conditions, which do not reflect the expected condition in a natural environment with fire as a component. When wildfire does enter these stands, they usually will burn at a higher severity than they would have under non-suppressed conditions. This results in a greater reduction in woody material available to stream systems than would have occurred during a fire in a non-fire suppressed stand.

Other parameters potentially affected to a greater extent due to the changed stand conditions include a reduction in stream shade, increased sediment delivery rates, changes in water chemistry and quantity, and a net reduction in available fish habitat.

Key Point

Fire has been removed as a component of natural systems. The net result is an unbalanced ecosystem with reduced water quality and less than desirable habitat conditions for fish.

Recommendations

6.A. Wildland Fire For Resource Benefit

The benefits to this type of treatment are that the post-fire effects to woody material recruitment and sediment delivery resemble natural processes, and the timing of the effects to streams and water quality closely matches the natural timing.

Watershed-scale monitoring should be conducted to determine where it is most appropriate to allow fire to burn within riparian areas and where these fires should be extinguished, and either treated with other methods or allowed to continue in their current suppressed state.

Potentially adverse effects to fish and water quality may occur, especially after the first precipitation event following the fire. Also, thresholds of adverse effect have been lowered in some areas due to past management and this action may cause a higher level of adverse effect than in non-managed areas.

Post-fire activity should limit the removal of wood from both riparian and upslope areas to help ensure adequate levels of wood are available for downstream recruitment. Post-fire activity should also not lead to accelerated soil erosion due to soil compaction or displacement.

6.B. Full Suppression

This option should be *only* used when weather and fuel conditions are such that a natural fire would burn at a much higher than natural severity; or in watersheds which have other designated uses (*i.e.*, municipal water supplies); or those which have remnant or isolated fish populations.

Continued suppression will likely not lead to healthy streams in the long term, so suppression should be viewed as a short-term fix, with plans developed to allow fuels treatment with one of the other methods in the long-term.

6.C. Prescribed Fire

This treatment type can be an effective tool to closely mimic the beneficial functions of natural fire while limiting the probability of high severity fire.

This tool is best used in watersheds with a more frequent fire return interval, but could potentially be used in infrequent fire return areas, although the prescription would have to allow for some stand mortality.

6.D. Mechanical Treatment

This treatment generally does not mimic natural fire processes. This treatment type is best used in conjunction with wildland fire for resource benefit or prescribed fire. Treatment that reduces fuel height (crushing, limbing, etc.) can be used in conjunction with prescribed or natural fire to mimic natural fire effects.

Treatment involving fuel removal (timber harvest and transport) may eliminate some sources of woody material for streams, and can lead to soil compaction or displacement.

Due to the ability to control the extent, duration, timing, and magnitude of this action, this treatment type may be best for some drainages where fire suppression has led to a much higher risk of natural fires burning at a higher than natural severity. In these drainages it is very important to treat the stands without causing adverse short-term effects to fish populations or important water sources (*i.e.*, critical spawning habitat for fish listed under the Endangered Species Act, or drainages immediately upstream from the diversion for a municipal water source).

Common Recommendation:

It is expected that fuel treatment activities will cause some injury or mortality to existing overstory vegetation. Post-fire management of these affected trees should be limited, and removal should only be allowed after the current and future recruitment needs for the

downslope streams are assessed. Impacts to soil through compaction or displacement should also be minimized.

ISSUE 7: AIR QUALITY

Fires significantly affected air quality in the past. Large fires produced high density, large-scale smoke events. Regular burning by American Indians produced smoke, primarily in late fall. However, smoke from fires was the only air pollutant source. Historical records show that smoke events, which limited visibility and would today be considered health risks, were common occurrences.

Large fires still occur, but much less frequently. Slash burning and grass field burning are reduced from the higher levels of the 1980s, since regulations to protect air quality were implemented. Prescribed fire smoke is primarily restricted to conditions where smoke is vented away from settled areas. The portion of air pollution attributed to fires is much reduced in the period since fire suppression and smoke management began.

In the future, as the area of managed low intensity fires increases, the amount of smoke produced in wildfire events will decrease. Typically, large wildfires burn more forest fuels, burn longer and the volume of smoke drifts where it will. Prescribed fires are of limited size, burning under conditions that limit the amount of smoke produced and the direction of smoke drift. The real effectiveness of an increased fuel treatment program may not be apparent for 20 to 40 years. Increased use of prescribed fire will eventually increase land managers' abilities to manage smoke.

More information on air quality can be found in **Appendix J**.

Key Point

Condition: Emissions from wildland fires have the potential to impact health and visibility.

Goal: Manage emissions from fuel reduction projects so there is minimal impact on health and visibility, and contribute to a long-term reduction in emissions from wildfire.

Recommendations

7.A. Wildland Fire for Resource Benefit (WFRB)

WFRB will cause a short-term increase in the quantity of smoke emissions, but the effects and expected direction of dispersal are considered when monitoring the progress of the event.

7.B. Fire Suppression

Smoke production is minimized in the short term, but additional smoke production is deferred to the future when the fuel loads are

higher and weather conditions more severe, resulting in large quantities of unmanaged smoke.

7.C. Prescribed Burning

Prescribed burning increases emissions in the short term, but will lower the total amount of emissions over the long term and lessen the effects on nearby communities.

7.D. Mechanical Treatments

Piling for later burning increases the amount of emissions, but defers emissions to times of atmospheric instability and visual impairment. When used as preparation for broadcast burning, emissions are increased, but the quantity and dispersal direction of smoke is controlled. Rearranging the fuel defers smoke production until it is consumed by a future wildfire.

ISSUE 8: SOCIAL THRESHOLDS AND THE WILDLAND/URBAN INTERFACE

Perceptions of forest conditions, and attitudes about wildfires affect our ability to strategically manage fuels. Areas of primary concern include, but are not limited to: human health and safety, personal property, and aesthetic values. Because research on the benefits of fire is relatively recent, education of citizens and agency personnel will be necessary to facilitate changes in attitude and perception.

Detailed information on the history of anthropogenic fire, current and desired future social conditions are found in **Appendix K**.

Principals and operating rules are articulated in **Appendix L**, "Incorporating Social Dimensions into Project-level Fire and Fuels Management Planning," and should be used by project-level planners to guide them in incorporating the social dimension into site-specific plans. These should be included in any treatment proposal regardless of treatment type or treatment location.

Key Points

8.1. Most people consider fire to be a dangerous and unpredictable menace.

The loss of life or property due to fire, regardless of origin, is inherently unacceptable.

Recommendations

8.1.A. Wildfire for Resource Benefit

Human habitation and development exists in all fire zones and includes recreational settings where human presence is intermittent. The probability of public resistance is high. Information, education and collaboration efforts should begin immediately to increase understanding of role of fire on the landscape. Project-level campaigns should tier to this broader approach.

8.1.B. Full Suppression

Full suppression is deeply embedded in the American psyche due in part to the successful Smokey Bear campaign. These perceptions and beliefs must be acknowledged and addressed. Information, education and collaboration efforts must focus on those parameters used to dictate when & why full suppression is the appropriate management option and when & why it is not.

8.1.C. Prescribed Fire

Prescribed fire is most acceptable when the public perceives that it will reduce the risk of catastrophic wildfire or to manage ecologic conditions by simulating historic fire regimes.

Support is less likely if people perceive that: there are potential health or visibility problems (smoke); water quality may be reduced; aesthetic or recreation site quality will be degraded; or there is a high risk of a fire escaping control efforts. Focus information, education and collaboration efforts on addressing those issues. Recognize that violating any of those core values will result in a loss of trust in Agency competency.

8.1.D. Mechanical Treatments

Human habitation and development exists in all fire zones and includes recreational settings where human presence is intermittent. The probability of public resistance is high only if treatment is seen as timber harvest. Information, education and collaboration efforts should focus on potential opponents to ensure understanding of the goals and objectives as well as the rationale for a mechanical treatment proposal.

8.2. Checkerboard ownership patterns pose challenges to firefighters, land managers and resource specialists.

Recommendations (common to all treatments)

Landscapes and land uses including structures and whether they are inhabited should be mapped to a GIS layer in coordination with other local agencies (see www5.ced.Berkeley.edu:8005/aegis/home/nfteam/radke/eb.html).

Partnerships with state and local agencies are critical to successfully addressing fuel treatments across the mosaic of land ownerships.

8.3. Public support for fuels management will depend on understanding and acceptance of proposed treatments.

Recommendations (common to all treatments)

See Key Point 8.1. for probable support or resistance levels by treatment.

Planners should use **Appendix L**, "Incorporating Social Dimensions into Project-level Fire and Fuels Management Planning," to guide them in incorporating the social dimension into site-specific plans. These should be included in any treatment proposal regardless of treatment type or treatment location.

8.4. Public education must address people's fears and concerns.

Recommendations (common to all treatments)

Focus on most often expressed reasons for disapproval of treatment methods: fear that fire would escape control efforts and endanger lives and/or property; concern that fires would harm natural systems; belief that natural systems are too complex to be managed with fire; and, belief that fires should not be allowed for any reason.

The "Living Classroom" concept is an effective way to provide adaptive learning opportunities. Check recreation sites and WUI areas for treatment where that location would facilitate learning/monitoring opportunities. Represent a variety of fire regimes/treatments (including controls) at accessible sites that lend themselves to understanding the complexity of fire in the ecosystem and fuel management treatments.

8.5. The interaction of fire and humans is most complex in the wildland/urban interface.

Recommendations (common to all treatments)

Consider the social complexity of any fuels management proposal early and often. Utilize the specialists who conducted the social component of the landscape-level strategy to assist with supplemental data gathering or public participation activities.

8.6. Poor access; poor mapping; poor water systems; and long response times may confound fire suppression efforts.

Recommendations (common to all treatments)

Inventory and map escape/evacuation routes and safe haven sites for areas where public safety may be compromised in a catastrophic fire event. As part of a risk assessment use the National Wildland/Urban Interface Fire Protection Program.

8.7. Fire and fuels management responsibilities are shared among a number of groups and agencies.

Recommendations (common to all treatments)

Partnerships and collaboration with private landowners/local agencies, especially where fuels are at a "high risk" level, are essential to a enhance treatment effectiveness.

8.8. People regard recreation and scenic areas in much the same way as private property.

Recommendations (common to all treatments)

Identify and prioritize "high risk" fuel-level sites for treatment to protect against catastrophic fires.

ISSUE 9: SAFETY

Protection of life and property is a top priority for fire management. The past policy of suppressing all fires at the smallest possible acreage appears to be increasing the risk to life and property. In the future, the way fire and fuels are managed will affect the level of risk to workers, the public, and to private property.

Key Points

9.1. Risk to firefighters can be reduced.

Fire fighters work in a hazardous environment. Strategic alteration of fuel profiles presents an opportunity for mitigating hazards to workers. One outcome of fuels modification is to reduce crowning or fast moving fires. Certain types of fuel loading and arrangement lend themselves to fast moving wild fires. Fast moving wildfires (on the west side, this is usually crown fires) pose an immediate risk to worker safety. Approximately 46% of fatalities among wild land fire fighters were due to fast moving fires 'over running' firefighters.

Recommendations

9.1.A. Wild Fire for Resource Benefit (WFRB)

The intensity and rate of spread of wild fires may be reduced by allowing low to moderate intensity fires to burn under certain conditions. Allow WFRB under conditions where low and moderate fire severity is likely to occur. Allow WFRB under weather and fuel moisture conditions that result in a high percentage of low and moderate intensity fire.

9.1.B. Full Suppression

During fire suppression, opportunities will arise to consider a suppression alternative that provides a larger fire perimeter, but minimizes risks to firefighters. For example, exposure of workers to steep ground, chimneys, snag concentrations and areas of heavy or flashy fuels may be minimized.

9.1.C. Prescription Burning

Prescribed fire in remote areas presents less risk to life and property. Prescribed fire treatment in areas of low risk to resources may in turn allow fire fighters to adopt a low risk strategy for containment and control of escapes.

Use prescribed fire in areas where risks to firefighters can be mitigated, at times when risk is determined to be at a minimum and

conditions provide a good probability of meeting land management objectives.

9.1.D. Mechanical Treatment

Mechanical treatment of fuels increases worker safety by reducing the intensity of subsequent fires, reducing the speed of fire movement, and reducing the amount of spotting. Mechanical treatment may be useful when other fuel reduction methods are unsafe or otherwise not acceptable.

9.2. Risk to life and property can be reduced

Risk to life and property is concentrated in the urban wild land interface zone. To reduce the risk to life and property, defensible space may be established both adjacent to developed areas and at strategic locations at some distance from developed areas.

Recommendations

9.2.A. Wild Fire for Resource Benefit (WFRB)

High intensity wildfires pose a risk to worker safety and to private property. The intensity and spread of wild fires may be reduced by allowing low to moderate intensity fires to burn under certain conditions in certain areas. Generally WFRB is not appropriate in proximity to developed areas. WFRB can be very useful in modifying overall landscapes so they are less prone to large-scale crown fires, which in turn would provide some protection to developed areas.

Contingency plans need to be developed for WFRB incidents.

Risk assessments need to be developed for residential areas, based on comprehensive mapping of the Wild land Urban Interface. The decision to allow WFRB, even at remote locations, must be based on these assessments.

At logical features within and around areas planned for WFRB, some units may find it useful to establish places where suppression would be most likely to result in safe containment of a WFRB (main roads, ridges, etc.). When fires occur and are outside of prescription, take suppression action at those pre-established features, or using those features as anchors for fire line. This would allow both direct and indirect attack.

9.2.B. Full Suppression

Develop complexity analysis for potential wildfires. Identify geographic zones where fire suppression is a high priority.

Develop risk assessments for urban interface zones.

Develop contingency plans for evacuating urban interface zones.

Where hazardous environments exist, consider allowing fires to burn through those areas, taking suppression action where conditions are safer. For example, modified suppression may be used to avoid hazards associated with steep canyons, chimneys, night shift on steep ground and areas with high concentrations of snags.

Make the decision whether or not to fully suppress early.

Assure that all workers use standard safety procedures.

9.2.C. Prescribed Fire

Prescribed fires should have contingency plans that include enough resources to safely attack Rx fires that are out of prescription.

Develop a fully trained work force of a size sufficient to manage prescribed fires. This includes both on-site forces and contingency forces.

Detail prescribed fire workers to other regions of the country during periods when Rx fire is not feasible in the project area.

9.2.D. Mechanical Treatment

Wildfires respond to fuels, weather and topography. The only fire behavior variable that humans can control to some degree is fuels. To manage the risk to life and property, establish areas where a fuels management project is likely to reduce ladder fuels or horizontal fuel continuity or total loading of available fuels[1]. A major objective of mechanical treatment should be to keep subsequent fires from torching and crowning, since crowning fires tend to move fast and spot frequently.

Treatment by mechanical mean may be most effective when used near areas where there is risk to private property from wildfire or escaped prescribed fires. Mechanical treatment may be most effective along strategic fuel breaks and within the wild land urban interface.

Treatment by mechanical means is already a feature of most silvicultural activities. It may be possible to intensify these efforts (chipping of pre commercial thinning slash, low thinning in commercial thins, yarding tops in thinnings) by incorporating fuels objectives and fuels funding into silvicultural activities to a greater degree than currently planned. Such activities may be most effective in short interval fire regimes and in areas of frequent fire ignitions.

[1] Cohen, J. *Preventing Disaster: Home Ignitability in the Wildland Urban Interface*, 2000 Journal of Forestry, 98(3):15-21.

Work in partnership with OSDF to complement their efforts in public education and fuels modification on private property.

Mechanical treatment may be effective when it serves to isolate an area of frequent fire starts. For example, sections of the Union Pacific main railroad line between Willamette Pass and Black Canyon have generated numerous fires over the years. Several approaches should be tested as pilot methods for containing this ignition source.

MONITORING AND EVALUATION

Monitoring is crucial to evaluating our success in reaching the goals of the Integrated Natural Fuels Management Strategy. Dealing with issues of fire suppression effects on vegetation pattern and diversity, fuels, wildlife and fish habitat, and the social dimension is a new management arena. Many of the treatments suggested in the strategy have been untested in the INFMS area. Careful evaluation of the range of treatment alternatives is needed to test their effectiveness in meeting goals and objectives.

An adaptive management approach to INFMS is recommended. By carefully designing a range of management activities to meet objectives, evaluate results, and modify our course accordingly, we can ensure we will meet our INFMS goals.

Monitoring and evaluation will serve to identify areas of this strategy or of treatment efforts that need improvement and formulate new strategies and treatment methods. Initial evaluation should occur before treatment is considered complete. This evaluation should discuss the strategy and treatment method used and the impacts to other resources while meeting fuels strategy objectives. It should also discuss whether firefighter safety was compromised and what changes might be made to better protect firefighters and still meet fuels strategy objectives. A copy of the evaluation should be filed with the project management package.

INTERDISCIPLINARY TEAM MEMBERS

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